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LETTER TO THE EDITOR

Live demonstration of surgery across international borders with uncompressed high-definition quality

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Abstract

To provide more efficient medical education and clinical training opportunities, we report our first successful experience of uncompressed high-definition (HD) transmission of live surgery from Korea to Japan. Laparoscopic distal pancreatectomy was performed in Korea and broadcast to Fukuoka, Japan, at the venue of the First Biennial Congress of the Asian-Pacific Hepato-Pancreato-Biliary Association (APHPBA) via super-fast broadband Internet on an academic fiber-optic network. The streaming of uncompressed HD images of live surgery was successfully performed with an interactive discussion between the two stations. The network remained stable throughout the session at as large a bandwidth as 1.6 Gbps. With respect to HD image quality, 92% of respondents reported that it was 'very good'. Use of this extraordinary high-quality image transmission will usher in a new era by providing much more accurate remote diagnosis and much better tele-education, not only in the field of hepato-pancreato-biliary surgery but also in many other fields of medicine.

Introduction

To provide more efficient medical education and clinical training opportunities, we established a new telemedicine system in 2003 linking Japan and Korea that allows streaming of original-quality surgical images over the Internet in a simple and economic manner [1]. Although high-quality digital video at 720×480 dpi was revolutionary, there have been further demands for even better quality with the emergence of high-definition (HD) endosurgical instruments with 1920×1080 dpi resolution. Although HD is becoming widespread in television broadcasting and in commercial use, Internet-based streaming of HD images remains challenging. To our knowledge, reports are limited to a few case studies of engineering research, and there has been no application to the medical field. We report our first successful experience of uncompressed HD transmission of live surgery from Korea to Japan.

Materials and methods

The Fukuoka International Congress Center, Fukuoka, Japan, the venue of the First Biennial Congress of the Asian-Pacific Hepato-Pancreato-Biliary Association (APHPBA), was linked to Seoul National University Bundang Hospital, suburban Seoul, Korea, via an academic fiber-optic network called the Korea-Japan Cable Network, a part of the Asia-Pacific Information Infrastructure. Endoscopic surgical images obtained in Korea, which were produced by the High Definition-Serial Digital Interface to a surgical video system (VISERA Pro, Olympus Medical Systems Corp., Tokyo, Japan), were directly converted into IP packets with the i-Visto Internet video studio system (Nippon Telegraph and Telephone Corp., Tokyo, Japan). The transmitted signals were then converted into HD moving images in Fukuoka and shown by means of an HD-compatible projector and a full HD plasma monitor. A cipher

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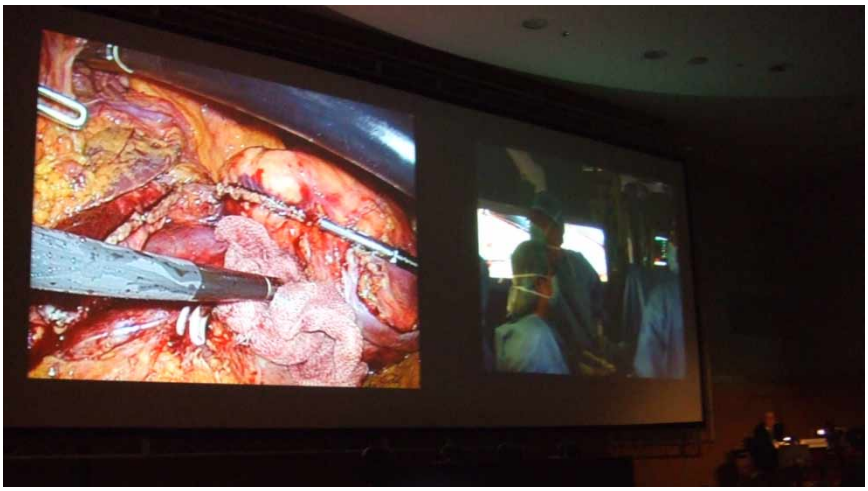

Figure 1. The meeting venue in Fukuoka, Japan, where participants watched uncompressed, high-definition live surgical images transmitted from Korea (left screen) and participated in an interactive discussion (right screen). A moderator is seen at bottom right.

security program, IPsec, was used to protect patient privacy.

Laparoscopic distal pancreatectomy in a 27-year-old woman with a cystic tumor, 6 cm in size, at the tail of the pancreas was performed in Bundang Hospital and broadcast to the Fukuoka venue. In addition to HD streaming of surgery, a Digital Video Transport System was set up for bidirectional communication [1].

A questionnaire was used to evaluate the quality of the surgical images. Possible responses to the questions were 'very good', 'good', 'poor' and 'very poor'.

Results

The uncompressed HD images of live surgery were transmitted for 2 h. The audience in Japan could see the surgical team in Korea and have an interactive discussion at the same time (Figure 1). The network remained stable at a bandwidth of 1.6 Gbps throughout the session. Of the 115 participants, 53 (46%) responded to the questionnaire. With respect to HD image quality, 49 (92%) respondents reported 'very good', 3 (6%) reported 'good', 0 (0%) reported 'poor' and 1 (2%) reported 'very poor'.

Conclusions

The streaming of uncompressed HD images of live surgery was successfully performed at the APHPBA Congress. As evaluated by over 90% of responding participants, the image quality was impressive. Because this transmission requires a huge bandwidth and all equipment between the two stations must be compatible due to the heavy transmission volume, this system cannot yet be applied to routine clinical use. There is little doubt, however, that rapid technological development of HD equipment will make this cutting-edge system more common and user-friendly in the very near future. Use of this extraordinary high-quality image transmission will usher in a new era by providing much more accurate remote diagnosis and much better tele-education, not only in the field of hepato-pancreato-biliary surgery but also in many other fields of medicine.

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